DOCUMENT RESUME

ED 283 301 EA 019 533

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TITLE Research Needs in the Field of Educational Facility Planning.
PUB DATE Nov 86
NOTE 12p.; Paper presented at the EDUSYSTEMS 2000 International Congress on Educational Facilities, Values, and Contents (Jerusalem, Israel, November 16-21, 1986).
PUB TYPE Information Analyses (070) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; Classroom Environment; *Educational Environment; *Educational Facilities Design; Research Design; Research Methodology; *Research Needs; *School Buildings; *Student Attitudes; *Student Behavior; Student Reaction; Teacher Attitudes; Teacher Behavior

ABSTRACT

Although the physical environment of schools seems to affect the attitude and behavior of students and teachers, there is little scientific proof to support this belief. Two substantial studies have attempted to synthesize available research on the topic. First, an effort by Carol Weinstein has gathered significant data concerning spatial behavior and the effect of student density on student attitudes, yet no consistent evidence existed regarding the impact of the environment on student achievement. In a second study by Carroll McGuffey, the only conclusive research involved the relationship of crowding, the age of the school building, and the visual, acoustical, and thermal environment to student behavior and learning activities. Foreknowledge of the effect of the environment on individuals is possible through the research of certain variables, but the deficiency of research renders generalization difficult. Consequently, more research must be done; more research must be synthesized; special designs should be developed to produce useful results; variables should be controlled and isolated; and limits on the comparison of studies should be compensated. A more quantitative strategy to synthesize research results is meta-analysis. The concentration of this technique on individual variables allows researchers to address areas needing further research. Included are seven references. (RG)

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ED283301

RESEARCH NEEDS IN THE FIELD OF EDUCATIONAL FACILITY PLANNING

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EDUSYSTEMS 2000
International Congress on
Educational Facilities - Values & Contents

November 16-21, 1986

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Introduction

Conventional wisdom in the area of educational facility planning and design seems to indicate that the physical environment does indeed have an effect upon the behavior, achievement and performance of the students and teachers who occupy these spaces. This seems to be a universal belief among those individuals who work in trying to house educational programs and students. Yet, so often this belief or feeling cannot be empirically demonstrated by those who hold to it, nor can they document research to that effect, but, of course, that does not hinder people from adhering to the belief.

Some 26 years ago Benjamin Handler reflected this view when he stated that there is a great deal of folk-lore, but very little scientifically grounded knowledge about the effect buildings have upon the people who occupy them (p. 13). This remark was made at the time the Educational Facility Laboratory of New York embarked upon an ambitious research program that engaged researchers from a wide array of fields of study such as engineering, mental health, physiology, education, meteorology, human engineering and other branches of psychology to determine the effect a school building has upon student's achievement and behavior. Even with such a grand scale effort at researching the effect of the building upon the occupant, eleven years later in 1971, Robert Anderson observed that there is little hard evidence to support the proposition that there is such a relationship (p. 278). In the fifteen years since that statement there has been considerable

research completed, but the body of hard research findings is still not to be found and it seems that the field of educational facility planning and design has come full circle to that point in time 26 years ago because even today we can observe that there is more folk-lore than empirical evidence to be found in planning and designing school facilities.

Recent Research Reviews

In the last few years there has been two substantial efforts to bring together and synthesize the available research findings regarding the relationship between the physical environment and the learning activities and attitudes of students.

The first effort was a rather monumental study done by Carol Weinstein and reported in the Review of Educational Research of 1979. She reviewed and reported on studies dealing with the relationship of the physical environment and selected variables. The major categories of her work were: specific environmental variables such as seating position, classroom design and furniture arrangement, density and crowding, privacy, noise, windowless classrooms, ecological studies of spatial behavior, and studies of open space in schools.

She reported that in spite of the large body of research on the influence of the physical environment on students, the "solid proof" does not exist as yet on that relationship. But the role of the school facility on the educational process is beginning to be better defined, but much more research needs to take place to

bring this relationship into focus. There is little evidence to suggest that the conventional classroom has any substantial positive effect upon student achievement. In addition, when the effect of such variables as furniture arrangement, aesthetic appeal and the presence or absence of windows are compared, differences in achievement are not significant. Weinstein also reported that:

> Likewise, short-term exposure to typical school noise appears to have no effect on performance, and laboratory investigations of the density-performance relationship are inconclusive. The only physical variable which has been linked to differences in school achievement is seating location and even here the data are somewhat inconsistent. (p. 598)

There is, however, more evidence that thee classroom environment has an effect upon behaviors and attitudes not associated with achievement. High levels of student density in the classroom have resulted in dissatisfaction, decreased social interaction and increased aggression, whereas, the "soft" classrooms have resulted in better attendance on the part of the student, greater participation and more positive attitudes toward peers and adults in the school. Also by reviewing the design of the classroom space, researchers have been able to identify changes in student's spatial behavior, increased interaction with materials, decreased interruptions and more substantive questioning (Ibid).

The second effort to compile research findings was contained in the chapter completed by Carroll McGuffey and published in Walbert's Improving Educational Standards and Productivity (p. 237). In this chapter, McGuffey surveyed the field of research

dealing with various elements of the school environment and their effect upon students. He reviewed research on the thermal, visual, aesthetic and acoustical environments as well as spatial and furniture requirements and condition of the structure.

According to McGuffey, research dealing with school building age, thermal, visual, acoustical environment and crowding was considered to have a significant relationship with learning activities and student behavior. But research on the effect of windows, condition of the facility, site size or open space either did not report significant findings or there were insufficient number of studies to report findings.

McGuffey cites 88 separate studies in his review of research in the physical environment. In a further discussion of the topic accompanying the Chapter by McGuffey, O'Fallon and Young listed and reviewed an additional nine studies (Ibid). Weinstein included 141 studies plus 21 additional references which were paper presentations of research efforts in her chapter presentation (p. 610). A total of 238 research studies plus 21 papers were documented in the two chapters. In this number of studies, there were only six that were cited by two or more authors--an overlap of less than 3% of the studies--which means that 232 separate research studies were cited by these reviewers.

What did these researchers find after reviewing all of these studies? One would think that a great deal of hard data would be available to the school facilities planner and designer. Even with this large number of research studies it is difficult to

determine any definite line of findings. McGuffey used 15 categories of variables to report the research, yet the number of studies in any of the categories was not large and as a result, it is difficult to generalize when there is a small number of studies (p. 288). For instance, underground facilities and windowless facilities were two such categories; each category had only one study cited. Obviously, there is insufficient research here to state any conclusions or to generalize beyond the specific studies. The dearth of research findings in other categories such as color, thermal environment and space is just as stark.

There has been a lack of suitable framework in which to consider how the constructed environment influences or effects human behavior. It is possible to evaluate certain aspects of the environment in a rather piece-meal manner by using research results from various disciplines or research efforts. For example, it is possible to determine the effects of various colors on behavior of students. So it would seem possible, for example, to evaluate the effects of a blue colored room or a red colored room upon the emotional or behavioral life of a student and in so doing arrive at some determination of how that environment effects the pupil. Red, orange, purple and black colors according to existing research findings, have a certain effect upon the behavior of students as contrasted to blue, green and similar shades. In this context it is possible to know before hand the effect of the environment--at least with very selected variables--upon the individual, therefore, these research findings

need to be utilized by the educators, architects, and engineers in the planning and design stage and not after the fact. Therefore, school planners and designers should specify colors that fit into the desired type of environment deemed necessary for the student to grow and learn. This means that a careful coordination must be established between the designer and the user of the space, whoever that may be, so that at least for those factors of the environment that deal with colors, the proper choice can be made before the environment is actually constructed.

This same process can be in operation for other segments of the environment for which research findings are available. The difficulty with this is that too often there is insufficient research data to adequately make some generalizations about the environment and the effect it has upon humans.

Existing Research Needs

With the recent emphasis upon the quality of education of students that have been brought to the attention of the United States as a whole through the various national committees and commissions, it would seem to follow that there could well be an increased interest in examining the location of the learning process and the relationship between student achievement/behavior and the physical environment. Perhaps these national reports on the status of education in the United States in the 1980's will serve as an impetus to direct more attention to research in the physical environment in which the process takes place.

There have been an increasing amount of experiments and studies done in this area of investigation, but the greatest bulk has been done only in the last decade. Certainly there needs to be more research done and a greater effort shown to gain understanding on a broader scale through combined efforts at synthesizing research. Further, there will need to be a maturing of the research efforts to systematically investigate the effect of the physical environment. This maturing will mean that researchers will need to mount efforts to overcome some of the problems that are inherent with the research area. The relationship between the physical environment and student behavior and achievement is so very complex that special designs will need to be developed to produce useable results. But also the methodological problems of trying to isolate and control the vast number of variables associated with student achievement and behavior will have to be attacked with increased vigor and insight. Further, the fact that most of the data gathering is a result of field based behavioral observations rather than true experimentations which then limits comparison of studies will have to be compensated for in order to produce some comparable results.

In addition to increased research efforts, another strategy that needs to be explored in trying to bring together research findings would be to have a meta-analysis of research findings in the general area of the physical environment done. Historically, research reviews in education have reported the summary of findings obtained through a perusal of related studies. A

meta-analysis through combing the results of independent experiments allows for a more quantitative approach to synthesizing results (Glass). Such analysis is usually conducted on a group of studies that are related through sharing a common conceptual hypothesis or operational definition of independent or dependent variables. A meta-analysis allows for two results: (1) a significant level that gives the probability that a set of studies exhibiting the found results could have been generated if no actual relation existed, and (2) the degree of overlap between experimental groups (Johnson, et al.). When used to examine survey studies from a specific research area, meta-analysis procedures allow both a characterization of the tendencies of the research as well as confirmation about the magnitude of any differences among conditions.

Because of the number of variables that are included in considering the normal physical environment of the school building, it would be necessary to complete a meta-analysis on the research that deals with just one general area or variable such as: light levels and quality; thermal, visual and acoustical environment; seating; hearing or privacy. These examples serve to set the parameters of the type of meta-analysis that will need to be completed. When such an analysis is completed, the source of research studies will have to be from the general field of architecture, engineering, human factors engineering, ergonomics, psychology, physiology, as well as other areas in the social sciences. A meta-analysis of research findings will bring

together the research to date and enable researchers then to develop a systematic strategy to address those areas that are in need of further investigation.

The type of research that will be useful to definitively describe the type of classroom space that is needed by school children to properly learn might follow the example of Kira who studied the bathroom of a house so that he could make design recommendations for a more logical and functional design (Rubin). He integrated research from several social and natural sciences to form an unified approach which covered such areas as anatomy, physiology, sociology, anthropometry, comfort, safety, acoustics, lighting, ventilation, odor, thermal environment, aesthetics, materials, and psychology. He stressed that although it was necessary to design the various components of the space, it was also necessary to bring together all elements into an integrated package.

Research efforts similar to those cited above need to be done in educational institutions to begin to provide for an integrated physical environment that will positively effect the humans who are occupying the space in their attempt to teach and learn in an efficient and effective manner. There is still a need to learn more about both the effect of various environments on different people and the effects of different people on various environments.

References

Anderson, R. The School as an Organic Teaching Aid. In R.M. McClure (ED), National Society for the Study of Education Yearbook, Part I. The Curriculum: Retrospect & Prospect. Chicago: University of Chicago Press, 1971.

Glass, G. "Primary, Secondary and Meta-analysis of Research." Educational Researcher, 1976, 5, p. 3-8.

Handler, Benjamin. Needed Research on the Effect of Buildings on Human Behavior. New Building Research Institute. Washington, D.C.: National Academy of Science, National Research Council, Fall, 1960.

Johnson, David, Roger Johnson, and Geoffrey Maruyama. "Interdependence & Interpersonal Attraction Among Hetrogeneous & Homogeneous Individuals: A Theoretical Formulation and a Meta-analysis of the Research. Review of Ed. Research Spring 1983, Vol. 53, No. 1, p. 5-54.

McGuffey, Carroll. "Facilities." Improving Educational Standards & Productivity. Herbert J. Walbert (ed.). Berkeley, California: McCutchan Publishing Corp., 1982, pp. 237-288.

Rubin, Arthur and Jacqueline Elder. Building for People. Washington, D.C.: National Bureau of Standards Special Publication 474, June, 1980, pp. 1-305.

Weinstein, Carol S. "The Physical Environment of the School: A Review of the Research." Review of Educational Research, Fall 1979, Vol. 49, No. 4, pp. 577-610.